

Letter from Alexander Graham Bell to Mabel Hubbard Bell, January 6, 1892, with transcript

ALEXANDER GRAHAM BELL TO MABEL (Hubbard) BELL Beinn Bhreagh, C. B. Wed. Jan. 6th, 1892. JOURNAL My dear Mabel:

No letter from you yet. Mr. McCurdy and I have hardly seen anything of one another for two days or more. He has had a severe attack of Photography-on-the-brain — complicated with thirst for correct lantern projection. He has been in town at photographers taking lessons in developing — and at tin-smiths making tin covers for lamps to be used for magic lantern.

He has quite an assortment now of photographs of you and me — and Elsie and Daisy on horseback and etc., etc., — positives on glass — suitable for lantern projection — taken from ordinary kodac negatives.

Grand Exhibition in warehouse on the topic for Saturday evening. I have been suffering also from a bad attack of flying machine — for some days past. Completed a very interesting series of experiments today. Just as the last experiment came to a close — the boiler burst — so I could not have tried any more if I wanted to. Results very promising — when we consider that our boiler could not stand much pressure. Think that an upright tubular boiler could be made to lift itself in the air — fuel and all — by fan wheel arrangement worked by a simple jet of steam. Even with the imperfect apparatus at our disposal — and the poor pressure — the jet moved the nozzle (with large wing attached) at the rate of nearly nine miles an hour. The two wings outstretched measured from tip to tip six feet — (all but $\frac{1}{4}$ of an inch) — 26 square feet of surface altogether.

With small wings only 30 inches from tip to tip — and not having more than about $\frac{1}{2}$ a square foot of surface altogether (in both wings) the nozzle traveled at the rate of 11 $\frac{1}{2}$

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miles per hour — making 136 rotations per minute. I think I told you of this experiment before — but gave you rotation from memory. Think I said 192. Find by reference to note-book it was 136 rotations per minute. The nozzle traveled 90 inches at each rotation — and therefore traveled 136 times 90 inches every minute. $136 \times 90 = 12,240$ inches in a minute = 1020 feet per minute. As there are sixty minutes in the hour the nozzle traveled 60 times 1020 in an hour. $60 \times 1020 = 61,200$ feet per hour or $11 \frac{1}{2}$ miles per hour. I enclose two photographs of the first machine — (taken by Mr. McCurdy.) The boiler shown is the first one used. The results above were obtained with another stronger and better boiler.

Have not got my old note-book here so cannot say just now when this apparatus was made. Think Dec. 27th, 1891. The note book I have here records experiments made with it Dec. 28th, 1891. The boiler burst on that day — and new boiler was made next day — completed Dec. 31st.

Apparatus as shown in photograph made 92 rotations per minute before the solder on top of boiler gave way. Wings measured 30 inches across — hence nozzle traversed $3 \times 30 = 90$ inches at each rotation. Distance traveled in one minute was therefore 92 times 90 inches = 8280 inches per minute. That is 690 feet per minute. 41,400 feet per hour = 7 miles per hour.

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The new apparatus used today had wings that measured 6 feet (almost) across. Have been testing effect of nozzles of different size. Following table of results is interesting and instructive.

Resumee of results obtained Jan. 6th, 1892.

Diameter of orifice of nozzle in fractions of an inch. No. of rotations per min. velocity of translation of nozzle. Duration of experiment in minutes. in feet per minute. in feet per second. in miles per hour. -0.1500 in. 8 144 2.4 1.6 2 -0.1100 16 288 4.8 3.3 3 -0.0600 28 504 8.4 5.7 8 -0.0365 43 774 12.9 8.8 7 -0.0235 30 540 9.0 6.1 6 -0.0100 22 396 6.6 4.1

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7 Absolute amount of alcohol and water consumed. Fuel and water consumed per minute. Amt. of water evaporated in gramme. Amt. of alcohol burned in gramme. Water consumed per minute in gramme. Alcohol consumed per minute in gramme. 55 22 27.5 18.8 50 25 16.6 8.3 156 48 19.5 6.0 140 45 20.0 6.4 96 48 16.0 8.0 Boiler burst.

Boiler 8½ inches diameter. Depth about 2 or 2½ inches (I think). Fire-box 4 inches diameter. 1¾ inches deep. Has five pipes for wicks — and a small air hole. Five wicks made of cotton waste.

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Much encouraged by results. If I can find a small boiler in Boston that will stand a decent pressure — will try some more experiments in Washington. And invite Prof. Langley to come and see them. Would like to see the thing go up.

With much love to Elsie and Daisy.

Your loving husband, Alec.